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GENERA OF MISSISSIPPIAN LOOP-BEARING BRACHIOPODA

STUART WELLER

INTRODUCTION

The correct specific determination of the loop-bearing brachiopod shells of the Mississippian faunas has always been attended with difficulty. This condition led the writer to undertake a critical study of a large amount of material, in order to determine, if possible, the true criteria for the determination of species. In this study the internal characters of the shell, as well as the external configuration, have been taken into consideration.

In the earlier literature all the shells of this type were included in the genus *Terebratula*, but since the appearance of Hall and Clarke's great work on the *Genera of Paleozoic Brachiopoda*,[1] it has been the usual custom to refer all of them to the genus *Dielasma*, although Girty has described one form as a member of the genus *Harttina*.[2] As a result of the present investigation, however, it has been found that forms which have been commonly included in a single genus, and in some instances, even, forms which have been referred to a single species, in reality represent several perfectly distinct generic types. The method used in the investigation is that which has been formerly used in the study of the Rhynchonelloid shells. Specimens have been ground from the posterior extremity and at short intervals the ground surface has been polished and a careful drawing made of the cross-section of the shell parts shown. From such a series of cross-sections of any shell it is easy to recognize the character and position of the internal lamellae, such as the median septum, the hinge-plate, the socket-plates, the bases of the crura, etc. In the course of the study it has been shown that the characters which can be considered as of generic value in these shells are to be found in the rostral portion of the brachial valve. Six and possibly seven good generic groups have been recognized, and will be defined here.

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[1] *Paleontology of New York*, Vol. VIII, Parts 1 and 2.

[2] "*Harttina indianensis* Girty," *Proc. Nat. Mus.*, Vol. XXXIV, p. 293.

DIELASMA King

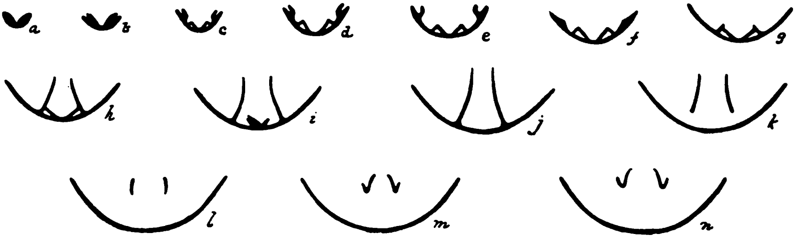

FIG. 1.—A series of fourteen cross-sections (×2½) of the rostral portion of the brachial valve of *Dielasma formosa* Hall.

Description.—Shell terebratuliform. Pedicle valve with or without a median sinus, the beak strongly incurved, the foramen large and encroaching upon the umbonal portion of the valve; internally with well-developed dental lamellae. Brachial valve usually without mesial fold; internally the crural plates are separate from the dental socket-plates, they diverge from the apex of the valve with an elongate attachment to the inner surface of the valve, the free portion of the brachidium is short, with diverging descending lamellae; between the crural plates for the full length of their attachment to the inner surface of the valve, is a concave, transverse plate for muscular attachment, which joins the inner surface of the crural plates a little above their base; this plate rests against the inner surface of the valve along the median line for a portion or the whole of its length, or it may be free throughout; when attached along the median line a pair of slender cavities, triangular in cross-section, converge from the general cavity of the shell toward the beak, but when the transverse plate is not attached along its median line there is a single, broad and low cavity beneath the plate, extending toward the apex; anteriorly this plate extends to a greater or less distance beyond the attachment of the crural plates and is pointed, rounded, or emarginate in front; its surface is marked by concentric wrinkles parallel with its anterior margin which are usually discontinuous along the median line.

Remarks.—The genus *Dielasma* was established by King with *Terebratula elongatus* Schl. as genotype, and although he defined the genus primarily upon the presence of prominent dental lamellae in the pedicle valve, and on the form of the loop, his illustrations of the internal casts of the species under the name *Epithyris elongata*[1] show that the crural plates are separate from the socket walls, one of the most essential features of *Dielasma* as here defined. Davidson[2] gives illustrations of the same species which exhibit all the essential generic characters of *Dielasma* most perfectly. The interpretation of the genus by Hall and Clarke[3] is identical with that here given, but those authors included certain species in the genus without sufficient investigation of their internal characters, which are fundamentally different; it has in fact been the usual custom among American workers, since the publication of Hall and Clarke's work, to refer all Mississippian terebratuloid shells to the genus *Dielasma*.

In specimens preserved in the condition of internal casts the generic characters of *Dielasma* are always very obvious, the position of the crural lamellae, separate from the socket-plates, being indicated by a pair of slits diverging from the beak of the brachial valve; when the transverse muscle-bearing plate is attached along its mesial line a second pair of diverging slits are present between those formed by the crural lamellae, and the finger-like casts of the slender cavities beneath the transverse plate are clearly shown, whether they are actually present or broken off. In specimens having the shell preserved the shell substance is frequently translucent enough to show the position of the internal lamellae as dark lines, in which case the genus can be recognized at once, and when the shell is opaque it is usually easy to determine the generic characters by the judicious use of a needle, without injuring the specimen as to its external form and characters upon which the various species are differentiated.

[1] *Monog. Perm. Foss. England*, Pl. 6, Figs. 37, 41 (1850).

[2] *Brit. Foss Brach.*, II, Permian, Pl. 1, Figs. 18, 20.

[3] *Pal. N.Y.*, VIII, Pt. 2, pp. 293–94.

Genotype.—D. elongata (Schl.). Other species, *D. formosa* (Hall), *D. shumardianum* (Miller), *D. fernglenensis* Weller, *D. burlingtonensis* White.

GIRTYELLA n. gen.

Description.—Shell terebratuliform. The pedicle valve sinuate, with a large, subcircular or subovate, oblique foramen which encroaches upon the umbo; the brachial valve frequently sinuate and often with a slight median fold in the bottom of the sinus. Internally the dental lamellae are well developed in the pedicle valve. In the brachial valve the socket-plates are joined by a concave hinge-plate which is imperforate at the apex and is supported by a median septum; the inner sides of the dental sockets retreat from the margins of the valve anteriorly beyond the point of articulation, and become the bases of the crura which are still joined by the concave hinge-plate and are also supported by lamellae resting against the inner surface of the lateral slopes of the valve. The brachidium short, its free portion apparently being like that of *Dielasma* and not reaching to the middle of the shell.

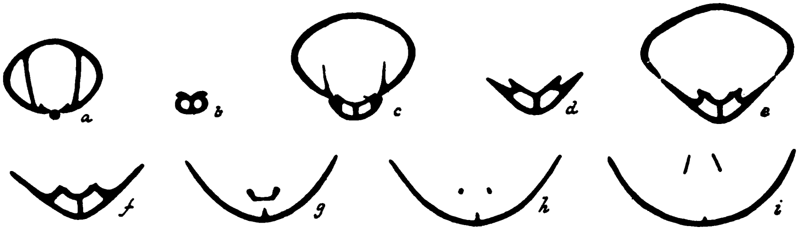

FIG. 2.—A series of nine cross-sections (×2½) of the rostral portion of the shell of *Girtyella indianensis* (Girty), three of which show both the pedicle and brachial valves, the others showing only the structure of the brachial valve.

Remarks.—Members of this genus have commonly been included in the genus *Dielasma*, but they differ fundamentally from that genus in the presence of a median septum supporting the hinge-plate of the brachial valve, and in the origin of the bases of the crura from the socket-plates. In his description of the species which is selected as the genotype, Girty referred the form to the genus *Harttina* on account of the presence of a median septum in the brachial valve, but the brachidium of *Harttina* is elongate, like that of *Cryptonella*, reaching nearly to the front of the shell, while that of *Girtyella* is short, like the brachidium of *Dielasma*.

Genotype.—*G. indianensis* (Girty). Other species, *G. turgida* (Hall), *G. brevilobata* (Swall.).

DIELASMOIDES n. gen.

Description.—Shell terebratuliform. Pedicle valve bisinuate toward the front in the genotype, the two depressions separated by a low, broadly rounded mesial elevation; the foramen large, oblique, encroaching wholly upon the umbonal region. Brachial valve with a slight mesial flattening or depression anteriorly in the genotype. Internally the dental lamellae are well developed in the pedicle valve; in the brachial valve the socket-plates are supported at their inner margins by a pair of lamellae which pass obliquely toward the floor of the valve to which they are joined near the median line; between these lamellae, the outer walls of the valve and the socket-plates, are a pair of cavities narrowly triangular in cross-section which expand anteriorly and open out into the general cavity of the valve; the crura originate from the anterior extensions of the inner walls of the socket-plates. Form of the brachidium not known.

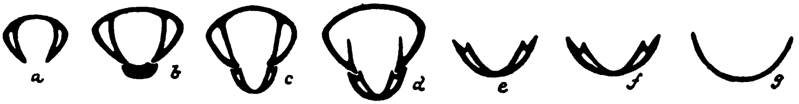

FIG. 3.—A series of seven cross-sections (×2½) of the rostral portion of the shell of *Dielasmoides bisinuata* n. sp., in the last three of which only the brachial valve is shown.

Remarks.—The characters of the rostral cavity of the brachial valve in this genus differ from those of *Dielasma* in the absence of any special crural lamellae distinct from the socket-plates. The two rostral cavities, narrowly triangular in cross-section, have a superficial resemblance in the two genera, but the narrow base of the triangle in this genus is formed by the socket-plate, while in *Dielasma* it is formed by the basal portion of the crural lamellae, and the special muscle-bearing plate between the bases of the crural lamellae of *Dielasma* is absent in this genus. This form is perhaps to be compared with *Girtyella* as the genus most closely allied to it. If the concave hinge-plate of *Girtyella*, which is supported by a median septum, be depressed along its median line to such an extent that the concave plate itself rests directly upon the floor of the valve, the median septum being eliminated, then we would have essentially the characters shown in this genus. The bisinuate folding of the anterior portion of the pedicle valve may be a generic character, but this cannot be determined from the single species so far recognized.

Genotype.—D. bisinuata n. sp., St. Louis (?) oolite, Lewis County, Mo.

CRANAENA Hall and Clarke

Description.—Shell terebratuliform. Pedicle valve with or without a median sinus and with well-developed dental lamellae of moderate length internally, the foramen large, oblique, and encroaching upon the umbonal portion of the valve, the beak incurved. Brachial valve without median fold, even in those species with a well-defined sinus in the opposite valve, but sometimes with a slight mesial depression near the front margin; internally the well-developed socket-plates are connected transversely

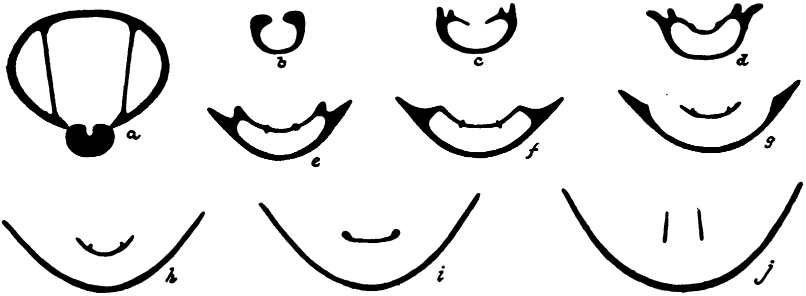

FIG. 4.—A series of ten cross-sections (×2½) of the rostral portion of the shell of *Cranaena iowensis* (Calvin), from all but the first of which the pedicle valve has been omitted.

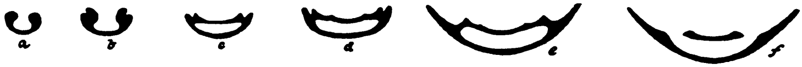

FIG. 5.—A series of six cross-sections of the rostral portion of the brachial valve of *Cranaena* sp. undesc., residual chest, Springfield, Mo.

by a concave hinge-plate which is perforated at the apex of the valve posteriorly; upon the inner or concave surface of the hinge-plate a pair of ridges originate at or near the anterior margin of the perforation and continue anteriorly across the plate, from the front of which they are produced into the crura. These crural ridges divide the hinge-plate into three equal divisions, or into two equal lateral divisions and a broader central one, and in some species the crural ridges are accompanied by similar ridgelike thickenings upon the opposite side of the hinge-plate. The brachidium short and *Dielasma*-like, not reaching to the middle of the valve.

Remarks.—This genus differs fundamentally from *Dielasma* in the origin of the crura from the thickened crural ridges of the hinge-plate, rather than from crural lamellae resting upon the inner surface of the valve, and in the absence of a special plate in the brachial valve for muscular attachment, the muscles being attached directly to the inner surface of the valve. From *Girtyella* the genus differs in the perforation of the hinge-plate, in the absence of a median septum in the brachial valve, and in the origin of the crura from crural ridges of the hinge-plate rather than from the anterior extension of the inner extremities of the socket-plates.

Genotype.—*C. romingeri* (Hall). Other species, *C. iowensis* (Calvin), *C.* n. sp., residual chert, Springfield, Mo.

HAMBURGIA n. gen.

Description.—Shell terebratuliform. Pedicle valve not sinuate in the genotype and only known species, the foramen large, oblique, encroaching upon the umbonal region; brachial valve without fold or sinus. Internally the pedicle valve is supplied with well-developed dental lamellae; the brachial valve with well-developed socket-plates which retreat from the lateral margins of the valve anteriorly beyond the articulation of the valves; they are connected transversely by a deeply concave hinge-plate which is separated from the inner surface of the valve by an exceedingly low and broad cavity; upon the inner or concave side of the hinge-plate a pair of ridges originate toward the apex and diverge slightly while becoming stronger anteriorly, finally passing into the bases of the crura; shortly in front of the point of origin of the crural ridges on the hinge-plate the socket-plates are rapidly reduced in height and soon become obsolete, beyond which point the hinge-plate is not connected with the inner surface of the valve, but becomes a concave plate joining the bases of the crura and terminating anteriorly in a short distance. The complete form of the brachidium is not known, but it is probably short, not reaching the mid-length of the valve.

Remarks.—This genus is perhaps most closely allied to *Cranaena*, from which it differs in the extreme concavity of the hinge-plate, the cavity between it and the inner surface of the valve being reduced in height, and in the absence of the perforation of the hinge-plate at the apex, which is, perhaps, the most diagnostic character. The genus is totally distinct from *Dielasma*, in which the crural plates originate as ridges upon the inner surface of the valve instead of upon the concave surface of the hinge-plate. The concave, transverse plate between the bases of the crura is somewhat similar in the two genera except that it is not connected along its median line to the inner surface of the valve in *Hamburgia*, but in *Dielasma* the inner surface of this plate furnishes attachment for the adductor muscles, which is apparently not true in *Hamburgia*.

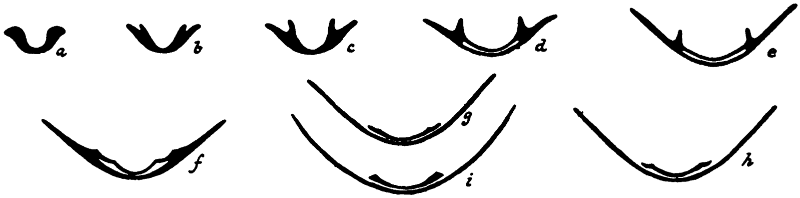

FIG. 6.—A series of nine cross-sections (×2½) of the rostral portion of the brachial valve of *Hamburgia typa*, n. sp.

Genotype.—*H. typa*, n. sp., Hamburg oolitic limestone of Kinderhood age, Hamburg, Ill.

DIELASMELLA n. gen.

Description.—Shell terebratuliform, compressed. Pedicle valve with well-developed dental lamellae of moderate length. Brachial valve without median septum or true hinge-plate, the socket-plates well developed, retreating from the lateral margins of the valve anteriorly and becoming differentiated into two portions, a basal portion which joins the inner surface of the valve and is directed obliquely inward, and a distal portion which is abruptly bent in a subgeniculate angle so as to be directed obliquely outward; the portion included in the angular bend of the two plates is produced anteriorly into the bases of the crura, and just before the crura become free a narrow transverse band joins their bases. The characters of the brachidium not completely determined, but it is believed to be of the short, *Dielasma*-like type. Shell structure finely punctate.

Remarks.—In the arrangement of the internal features of the apical portion of the brachial valve this genus is perhaps more closely allied to *Cranaena* than to any other of the generic types here recognized. It differs from *Cranaena* chiefly in the reduction of the hinge-plate to a narrow, transverse band joining the crural bases, while in *Cranaena* it is elongate, with a comparatively small apical perforation, and with the crura originating as a pair of ribs diverging anteriorly from near the apex. The difference in shape, viz., the compressed shell and the erect beak of the pedicle valve, are other features which easily separate the members of this genus from all species of *Cranaena* which have been recognized.

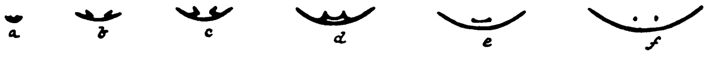

FIG. 7.—A series of six cross-sections (×2½) of the rostral portion of the brachial valve of *D. compressa* (Weller).

Genotype.—*D. compressa* (Weller). Glen Park limestone.

ROWLEYELLA n. gen.

Description.—Shell terebratuliform, with the valves subequally convex. The beak of the pedicle valve perforated by a subcircular foramen which encroaches wholly upon the umbonal region, the delthyrium broadly triangular and wholly closed. Internally each valve is supplied with a strong median septum which, in the pedicle valve, reaches nearly to the center of the valve, that of the brachial valve being somewhat shorter.

Remarks.—The relationships of this genus cannot be certainly determined from the material available for study. The general contour of the shell at once suggests its affinity with the terebratuloid, loop-bearing shells, as also does the character of the foramen of the pedicle valve, and so far as it can be observed the delthyrium and its covering. The shell structure has not been certainly determined. Upon one example a punctate structure is slightly suggested, but that characteristic structure of the terebratuloids cannot be said to be demonstrated. The characteristic of these shells which is most foreign to the terebratuloids is the strongly developed mesial septum of the pedicle valve, which evidently supports a well-developed spondylium, and the presence of this character in association with a strong median septum in the brachial valve suggests the family Pentameridae, but it has not been determined that a cruralium accompanies this median septum of the brachial valve. This feature of a median septum in the pedicle valve has not been recognized heretofore among the loop-bearing terebratuloids, although there is perhaps no reason why it should not exist, but a median septum in the brachial valve occurs in at least one genus of these shells.

In any event the characters exhibited by these shells exclude them from any described genus among either the terebratuloids or the pentameroids. The presence of a pedicle median septum is sufficient to differentiate the genus from any other of terebratuloids, if indeed it be one of these shells, and the characters of the foramen and delthyrium differentiate it from any pentameroid. The shell perhaps agrees most closely in the sum of all the characters present with the spire-bearing *Camarophorella*, but there is no evidence, in the specimens observed, of the presence of a brachial platform associated with the median septum of that valve, as is true in *Camarophorella*.

Genotype.—*R. fabulites* (Rowley), Burlington white chert, Louisiana, Mo.